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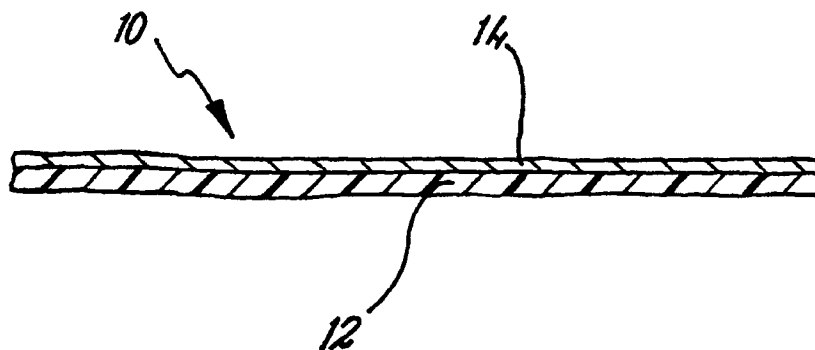
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(54) Title: MEAT PRODUCT PACKAGING



(57) Abstract: There is disclosed a meat product packaging comprising a sheet material substrate having a beneficial substance f.i. antimicrobial attached thereto.

WO 01/49121 A1

Meat Product Packaging

This invention relates to meat product packaging.

Recently, there has been considerable public concern about contamination of meat products with harmful microbial species. Such contamination has given rise to increasing incidents of food poisoning. A well known and common example is infection with the E-coli bacterium, in particular the drug and acid resistant E-coli 0157 strain.

It should be noted that many microbial infections do not colonise the interior regions of a meat portion (or a "cut" of meat). Rather, contamination occurs by contact with intestinal microbes during the meat processing stage. Thus, the contamination is present on the surface of the cut of meat. Poultry products are particularly prone to infection in this way, for example, by the salmonella bacterium. E-coli is also transmitted in this way, i.e., on the surface of the meat product.

The present invention recognises the significance of surface contamination of meat products, and provides a cheap and convenient way of inhibiting or preventing microbial infection of meat products. In addition to providing a more hygienic product for the consumer, the present invention provides the possibility of increasing the shelf life of meat products, thereby providing substantial savings for the retailer.

According to a first aspect of the invention there is provided meat product packaging comprising a sheet material substrate having a beneficial substance attached thereto.

The beneficial substance may be an antimicrobial agent, or some other substance which is beneficial in some way to the condition, quality or value of the meat product, for example an anti-oxidant to prevent discolouration, or a flavour enhancing substance, or colourants, or combinations thereof. The packaging may be used to allow the phased release of the beneficial substance to the meat.

The sheet material substrate may be a plastic film, which may be shrink wrap film or cling film.

The antimicrobial agent may be active against moulds and bacteria, preferably gram negative bacteria, in particular E-coli and Salmonella. The antimicrobial agent may be a naturally occurring substance such as an essential oil which may contain, for example, linalool, terpineol, eugenol, thymol, citral or carvacrol, or may be a synthetic antimicrobial such as an ester of 4-hydroxybenzoic acid, or a compound capable of releasing an antimicrobial gas such as sulphur dioxide or chlorine dioxide, or combinations thereof. Alternatively the antimicrobial agent may be Citrex (RTM) (manufactured by Special Nutrients Inc of 1314 Coral Way, Miami, Florida, USA) or CitroX (RTM) (which can be obtained from Chemie Technology Limited, Middlesborough, UK).

The beneficial substance may be coated to the sheet material substrate.

The beneficial substance may be attached to the substrate by a bonding agent. The bonding agent may comprise a lacquer, which may be an acrylic lacquer.

The bonding agent may comprise a polymer which may be a hydrophilic or a lyophobic polymer. The polymer may swell on contact with a release agent, such as moisture or a fat, thereby releasing the beneficial substance.

According to a second aspect of the invention there is provided a packaged meat product comprising a meat product packaged within packaging according to the first aspect of the invention. The meat product may comprise a unitary portion of meat (i.e., a steak or a joint of meat, but not minced meat). The sheet material may be in direct contact with the meat product.

Embodiments of packaging in accordance with the invention will now be described with reference to the accompanying drawing, which shows a cross sectional view of meat product packaging according to the invention.

The Figure shows meat product packaging (shown generally at 10) comprising a sheet material substrate 12 having an antimicrobial agent 14 attached thereto. The use of other beneficial substances, such as anti-oxidants, flavour enhancers and colourants, either individually or in combination with other beneficial substances, is within the scope of the invention.

By packaging meat products with packaging of the present invention, microbial growth can be inhibited or prevented over a critical period of time leading up to the removal of the product from the packaging (which is usually, although not always, for immediate consumption or cooking).

Preferably, the sheet material is a plastic film, most preferably a shrink wrap film or cling film. Shrink wrap film can be shrunk, by the application of heat, directly onto the surface of a meat product. Cling film is pliable plastic film which can be stretched and wrapped around a meat product. In either instance, the sheet material is in direct intimate contact with the meat product. In this way, the coated antimicrobial agent acts directly upon the meat product. An alternative approach is to utilise an antimicrobial agent which is effective as a vapour, or which can be converted into a

volatile species - in this instance there would be no need for direct contact with the meat products. However, meat products are typically stored by refrigeration or by freezing with a consequent reduction in vapour pressure compared to room temperature storage. With most antimicrobial agents this is a severe problem, but the present invention recognises this approach is, in principle, possible. Such an approach could be usefully applied to the packaging of "non-unitary" meat products such as minced meat.

It may be possible to utilise the sheet materials, such as paper, to produce packaging according to the invention. Also, it is possible to provide packaging in which the sheet material substrate of the present invention is a component of the packaging. An example is packaging comprising a tray into which the meat product is disposed and plastic film which is stretched across the open face of the tray.

The meat product packaging can be for packaging such products prior to delivery to shops and other food outlets. Alternatively, the packaging may be intended for domestic use. An important example is cling film, which can be used when desired in the home to wrap or otherwise package meat products. Cling film of the present invention, having an antimicrobial agent attached thereto, might usefully be employed in covering plates of meat products at a buffet and other social functions where the meat product might be left at room temperature or above for several hours prior to consumption. It should be noted that such cling film can be used to wrap or package non-meat products as well, depending on the wishes of the end user. Furthermore, the antimicrobial properties of the present invention might prove useful when used to package such non-meat products. Thus, packaging of the present invention, in particular cling film, might have application to foodstuffs *per se*.

The invention is not limited with regard to the antimicrobial agent utilised. Examples include naturally occurring substances such as essential oils, for example,

rosemary, lemon grass, teetree and garlic oils. The essential oils can comprise linalool, terpineol, eugenol, thymol, citral or carvacrol. Synthetic antimicrobial agents such as an ester of 4-hydroxybenzoic acid might be used or, as noted above, an inorganic compound capable of releasing an antimicrobial gas such as sulphur dioxide or chlorine dioxide might be used. Such release coatings are described in US 3559562, the contents of which are incorporated by reference. The coatings consist essentially of a mixture of sodium sulphite and fumaric acid, or sodium metabisulphate dispersed in a wax or lacquer coating. Another possible agent is supplied under the brand name "Citrex" (RTM) by Special Nutrients Inc of 1314 Coral Way, Miami, Florida, USA. Citrex inhibits the growth of E-coli, is inexpensive and has a high flash point and thus survives drying processes. Furthermore, it has been found that Citrex (RTM) is readily printable in an alcoholic solution, which enables a number of print application methodologies to be employed. Another possible antimicrobial agent still is supplied under the brand name "Citrox" (RTM) and may be obtained from Chemie Technology Limited, Middlesborough, UK.

The antimicrobial agent is coated to the sheet material substrate using a suitable bonding agent. In selecting a bonding agent, important considerations include i) suitability for use with foodstuffs ii) cost and iii) the ability to expose the antimicrobial agent to the meat product, possibly by the release of the antimicrobial agent at a suitable rate and over a suitable time scale.

Suitable bonding agents include polyvinyl alcohol, polyvinyl acetate, cellulose derivatives and acrylic lacquers. Examples of acrylic lacquers are supplied under the brand names "Sigma" and "Pinnacle" by Mirage Inks Limited, of Radstock, Bath, UK, BA3 3AP. Hydrophilic polymers, such as polyvinyl alcohol which swell on contact with moisture to release the active ingredient can be used. Lypophilic polymers, such as polyvinyl acetate, which are more effective in releasing the active ingredient in

the presence of fats and oils can be employed as bonding agents. Combinations of hydrophilic and lypophilic polymers may be used to optimise and control the rate of release of the beneficial substance in any particular application. The bonding agents may be cross-linked to control the degree of swelling when exposed to the releasing agent.

The concentrations of antimicrobial agent and bonding agent, together with the coating thickness and hydrophilic/lypophilic balance, are variables which depend on the precise application envisaged. International Publications Nos. WO96/10905 and WO97/06074 (assigned to the present applicant) describe methodologies for coating substrates with "beneficial substances", of which an antimicrobial agent would be an example. In International Publication No. WO96/10905, coated substrates are described which permit phased release of the beneficial substance, over a period of time, due to the action of a release agent on the bonding layer. In the case of the above described lacquers, the release agent is water, which dissolves the lacquer over a period of time, thereby releasing the antimicrobial agent. The phased release characteristics can be varied by using reducers, such as acetate or propylacetate, as dilutants. In the case of the hydrophilic and lypophilic polymers, the release agent can be water and fats, respectively, which release agents cause the polymer to swell over a period of time, releasing the antimicrobial agent (or other beneficial substance). The phased release characteristics can be varied using different combinations of hydrophilic and lypophilic bonding agents. In International Publication No. WO97/06074, a different coating methodology is described in which a large ratio of beneficial substance to bonding agent is employed to directly expose the beneficial substance to its intended target. The intended time scale of use is much shorter than with the phased release methodology of International Publication No. WO96/10905. The general methodologies described in International Publication Nos WO96/10905 and WO97/06074 might be used to produce packaging according to the present invention.

As a representative example, coating thicknesses in the range 2 to 5 μm are generally considered desirable. Such coating produces a loading in the region of 4g dry weight per square meter of substrate coated. Clearly this figure depends on the precise nature of the coating solution mixture and any reducers employed in the solution. It will be appreciated that the optimal conditions are dependent on any release or dissolving agent employed, the required time scale of use and on the desired rate of absorption of antimicrobial agent, which will vary according to the type of meat which is being packaged.

It will be appreciated by the skilled reader many coating techniques are applicable, including various printing techniques. As an example, a pyramid pattern anilox roller system can be used on the coating roller in order to vary the coating thickness. Although it is typical for the antimicrobial agent to be mixed with the bonding agent prior to coating, it is also possible to deposit a layer of antimicrobial agent on the substrate, and to overlay the antimicrobial agent with bonding agent. Spray coating is another possibility.

The surface of the packaging having the antimicrobial agent attached thereto can be brought into contact with the meat product. Alternatively, it is possible to have an uncoated surface exposed to the meat product, and allow the antimicrobial agent to migrate through the substrate. In this instance, the thickness and the density of the substrate are selected to optimise such migration.

Example

A roll of polythene bags was coated with a layer of Citrex in a water based acrylic lacquer (MAX 23482, Mirage Inks Limited, Radstock, Bath, UK). Coating was

performed using a 1:10 dilution of a 0.5% Citrex preparation. The dilution was achieved using the following dosage rate: 1l of 0.5% Citrex solution; 7l of lacquer; 2l of water.

Another, untreated roll of polythene bags was used as a control. A positive control was created in the laboratory by coating some of the control plastic with a 2.5% Citrex preparation.

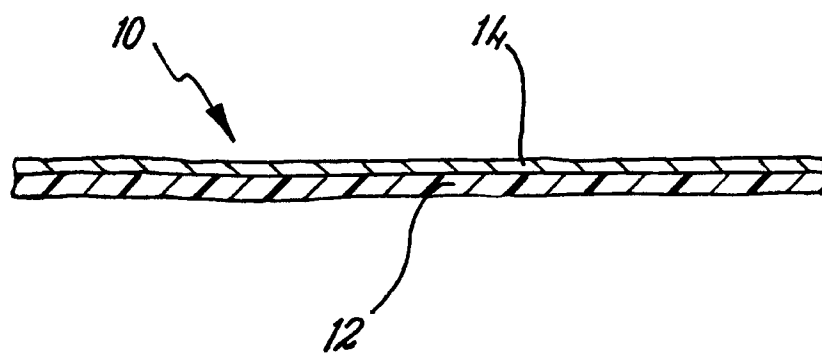
A suspension of *Salmonella typhimurium* was prepared by scraping cells from an agar plate and re-suspending in diluent containing 5 g/l agar. Small drops of this suspension were then placed onto the surface on the plastic, and after a defined contact time, were recovered using a swab and placed onto nutrient agar. Results showed that both the treated plastic and the positive control killed the *Salmonella* over 24 hour contact time.

CLAIMS

1. Meat product packaging comprising a sheet material substrate having a beneficial substance attached thereto.
2. Meat product packaging according to claim 1 in which the sheet material substrate is a plastic film.
3. Meat product packaging according to claim 2 in which the plastic film is shrink wrap film or cling film.
4. Meat product packaging according to any one of claims 1 to 3, in which the beneficial substance is an antimicrobial agent.
5. Meat product packaging according to claim 4, in which the antimicrobial agent is active against moulds.
6. Meat product packaging according to claim 4, in which the antimicrobial agent is active against bacteria.
7. Meat product packaging according to claim 6, in which the antimicrobial agent is active against gram negative bacteria.
8. Meat product packaging according to any one of claims 4 to 6, in which the antimicrobial agent is a naturally occurring substance.
9. Meat product packaging according to claim 8, in which the naturally occurring substance is an essential oil.

10. Meat product packaging according to claim 9, in which the essential oil contains linalool, turpineol, eugenol, thymol, citral or carvacrol.
11. Meat product packaging according to any one of claims 4 to 7, in which the antimicrobial agent is an ester of 4-hydroxybenzoic acid.
12. Meat product packaging according to any one of claims 4 to 7, in which the antimicrobial agent is a compound capable of releasing an antimicrobial gas.
13. Meat product packaging according to any previous claim, in which the beneficial substance is coated to the sheet material.
14. Meat product packaging according to any previous claim, in which the beneficial substance is attached to the substrate by a bonding agent.
15. Meat product packaging according to claim 14, in which the bonding agent is lacquer, preferably an acrylic lacquer.
16. Meat product packaging according to claim 14, in which the bonding agent comprises a polymer.
17. Meat product packaging according to claim 16, in which the polymer is hydrophilic.
18. Meat product packaging according to claim 16, in which the polymer is lypophilic.

19. Meat product packaging according to any of claims 16 to 18, in which the polymer swells on contact with a release agent, thereby releasing the beneficial substance.
20. A packaged meat product comprising a meat product packaged within packaging according to any of claims 1 to 19.
21. A packaged meat product according to claim 20, in which the meat product comprises a unitary portion of meat.
22. A packaged meat product according to claim 20 or claim 21, in which the sheet material is in direct contact with the meat product.



INTERNATIONAL SEARCH REPORT

International Application No

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A. CLASSIFICATION OF SUBJECT MATTER

IPC 7 A23B4/20 A23B4/16 A23B4/18 A23L3/3463 A23L3/3409
A23L3/3445 A23L3/3517 B65D81/24 B65D81/28

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)

IPC 7 A23B A23L B65D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data, PAJ, FSTA

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category *	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
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☒ Further documents are listed in the continuation of box C.

☒ Patent family members are listed in annex.

* Special categories of cited documents:

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International Application No

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